Article

Peer Tutoring and Math Digital Tools: A Promising Combination in Middle School

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Abstract: Peer tutoring in combination with math digital tools was employed with middle school students learning mathematics. A total of 112 students in 9th grade (14 to 15 years old) participated in the study. A pretest–posttest with control group design was used. Students worked with systems of linear equations during the experience. The effects of the intervention of peer tutoring in combination with math digital tools on students' mathematics achievement were examined using quantitative methods. The way students in the experimental group learned and their motivation towards using digital tools compared with students in the control group were analysed qualitatively. Statistically significant improvements and a large effect size were reported for students' mathematics achievement in the experimental group. No statistically significant differences were reported between the pretest and the posttest for the control group. The qualitative analyses revealed that students in the experimental group achieved a higher level of autonomous learning, showed a greater association of mathematical concepts, helped their peers more, did more exercises and problems than students in the control group, and enjoyed the experience.

Keywords: peer tutoring; digital tools; mathematics achievement; autonomous learning

MSC: 97C30

1. Introduction

1.1. Background

1.1.1. Peer Learning and Computers, Then and Now

Research on peer learning aided by computers has been carried out for more than three decades. The first studies that incorporated peer learning and computers took place during the late 1980s and the 1990s [1,2]. These studies highlighted the potential academic benefits of combining peer learning and computers. This way of learning was believed to be very valuable by most researchers in the field, given its promising results. Over the last several years, the psychological and social benefits of this type of learning experience have been documented [3–5]. As several authors [6,7] suggested, combining peer learning and digital tools allows students to broaden their academic knowledge from different perspectives and reinforce previously acquired skills. Moreover, as other authors [8,9] indicated, students' motivation and self-concept may also be increased by including digital tools in peer tutoring activities. Although several studies have contributed to the literature in the field and the potentiality of this combination has been strengthened, most authors argue that this field of study is still underdeveloped [10–14].

1.1.2. Peer Tutoring and Math Digital Tools

A recent meta-analysis by [15] analysed the learning effects of using digital tools in secondary education science and mathematics. A comparison of the learning effects when the students received support from their peers and when they did not receive any

support from peers was carried out. Although statistically significant differences were not reported, learning with support by peers yielded considerably larger effect sizes than learning without support by peers. These authors highlighted the need for more studies in the field to address this issue in more depth, as the results of the comparison were inconclusive. Ran et al. [16] also suggested that math digital tools could be especially beneficial when peer tutoring is involved. As some studies have indicated, not only average or high-achieving students should benefit from peer tutoring by means of math digital tools but also those whose performance in mathematics is low or who are enrolled in special and remedial education. The study carried out by Tsuei [17] showed that digital tools had significant effects on learning outcomes for low-achieving children in mathematics when implementing peer tutoring. Moreover, these tools also facilitated the tutor's demonstration of solutions, indicating errors and providing guided instruction. As several authors [18–20] indicated, combining peer tutoring with math digital tools improves student interactions by providing just-in-time feedback and enabling students to receive relevant support and feel more accountable for the collaboration. Hence, given the need for more studies in the field as these examples illustrate, and given the recent promising results in other similar studies, the following research study was conducted.

1.2. Novelty of Research

In this research, peer tutoring was employed in combination with math digital tools in a middle school mathematics setting; students used the same digital tools and shared the same resource (tablet) and space (classroom), so they worked alongside each other rather than being physically separated. The novelty of our research resides in the fact that the majority of peer learning studies that include the use of digital tools involve remote learning, distance learning, or online interactions [21–25]. Several authors have recently indicated that even though information communication technologies (ICTs) enable pairs or groups of students to efficiently communicate at a distance, the physical distance between them may significantly alter not only the way they interact but also the way they help themselves and learn while they share their knowledge [26–30].

Considering the potentiality of combining peer tutoring and math digital tools, the following subsection presents the aim and research questions addressed in this study.

1.3. Study Objectives

The objectives of this study were to analyse (1) the effect of peer tutoring in combination with math digital tools on students' mathematics achievement and (2) the effect of peer tutoring in combination with math digital tools on the way students learn and their motivation towards using math digital tools.

2. Materials and Methods

2.1. Sample

Ninth-grade students (14 to 15 years old) from a public middle school in Spain participated in the study. The school was selected by cluster sampling [31] from among the population of public middle schools in the Valencian community. Of the total of 112 students who participated, 50.47% were female and 49.53% were male. At the beginning of the intervention, the average age was 14.31 years old with a standard deviation of 0.17 years. Of the total, 78 (69.64%) were Hispanic, 17 (15.18%) were Rumanian, 15 (13.39%) were African, and 2 (1.79%) were Asian; the socioeconomic status of the students' families was average. Among the student participants, 102 (91.70%) had access to a tablet, laptop, or desktop computer for personal use at home, and all participating students had personal cell phones with Internet access. The students, who were separated into four classes, were randomly assigned to the experimental or control conditions. Due to organizational issues and a limited number of digital resources available for the intervention, only a quarter of the students were assigned to the experimental group, and the remainder were assigned to the control group. Hence, 28 students (a single classroom) were assigned to the experi-

mental condition, and the other 84 (3 classrooms of 28 students each) were assigned to the control conditions.

2.1.1. Power of the Sample

StudySize 3.0 software by Creostat HB was used to determine the sample power. A sample power of 0.87 was determined for the sample of 112 participants (28 in experimental condition and 84 in the control group) when using Student's *t*-test with a significance level of 0.05.

2.1.2. Adequacy of Randomization

Students' scores in all groups and phases of the study (pretest and posttest for the experimental and control groups) followed a normal distribution ($p > 0.95$ for all cases) based on a Kolmogorov–Smirnov test. No statistically significant differences were reported for the pretest between the experimental and the control group ($t = 1.66$, $p = 0.22$).

2.2. Authorizations and Ethical Requirements

This research was conducted as part of an innovation project awarded by the Valencian Ministry of Education in a public competition. Informed consent was obtained from the students' parents to conduct the research. The Valencian Ministry and the assigned education inspectors supervised the research. Ethical requirements were also supervised during the evaluation of the project by the Valencian Ministry. Students participated in the research on a voluntary basis.

2.3. Intervention
2.3.1. Experimental Design

A pretest–posttest with control group design was used in this research. The inclusion of control groups is highly recommended by several authors in the peer-tutoring field [32–34]. According to these authors, not including a control group when investigating the effects of peer tutoring interventions may result in an overestimation of the effect of the intervention.

2.3.2. Mathematical Content Covered

The main mathematical content covered during the intervention involved systems of linear equations. All content was contained in the sixth mathematics unit of the mathematics school year (systems of equation solving). All systems included two equations and two unknown variables; that is, all systems were 2 × 2. The following content was covered: the identification of the type of system of equation (compatible system determined, compatible system indeterminate, incompatible system); three ways of analytical system solving (row reduction, substitution, and equating); graphical system solving, and problem solving.

2.3.3. Organization, Schedule, Frequency, and Duration of Intervention

During the first trimester of the 2019–2020 school year, students in both the experimental and control groups received traditional teaching instruction: that is, the teacher employed the one-way instructional teaching method. Students had to work individually; they could ask the teacher questions at any time, but interactions between the students themselves were limited. After the first trimester, an intervention of peer tutoring combined with using math digital tools was implemented with students in the experimental group. This intervention lasted one month (four weeks). Throughout this month, four sessions of peer tutoring with math digital tools were conducted each week during mathematics classes; each session lasted approximately 25 min. During the intervention month, students in the control group continued with the one-way instructional teaching method while sitting in pairs.

2.3.4. Type of Tutoring and Distribution of Students

Reciprocal peer tutoring was implemented. This type of tutoring was selected considering the students' previous scores for the first trimester in mathematics [35]. Students in pairs helped and tutored each other during the intervention. These student pairs were formed following the structured system indicated by Alegre et al. [36]. Students were ordered from highest to lowest according to their mathematics scores from the first trimester. Then, the first student was paired with the second student, the third was paired with the fourth, and so on. When employing this type of peer tutoring (i.e., reciprocal), mathematics achievement differences between pairs are minimized since each student is paired with another student with a similar achievement level in mathematics [37,38].

2.3.5. Math Digital Tools, Materials, and Resources

Fourteen 2016 Samsung Galaxy Tab A 10.1" 32 GB tablets were acquired for the intervention project. Each pair of students in the experimental group shared one of these tablets during mathematics class. Each tablet was connected to the Internet through the school's Wi-Fi network.

The teacher had a desktop computer with a digital screen, and a conventional blackboard was also available in the classroom. Four main online math tools were used, which were selected based on their being freely available to the students and on their simplicity and intuitiveness of use. First, students used Symbolab by EqsQuest Ltd. (Telaviv, Israel) to perform the three methods for analytically solving the systems. This tool provided not only the solution for each system but also a step-by-step procedure for each method of solving the system. Fooplot by Dheera Venkatraman was used for the graphic solving of equations. Using a very simple approach, students had to introduce each equation, and the system of equations was graphically represented. Wims Linear Solver version 2.24 was used to identify the type of system. The advantage of this tool over others available on the Internet was its simplicity and the fact that it provided an accurate and concise response on the number of solutions of the system (none, one, or infinite) as an output. Kahn Academy's systems of equations word problems were used for problem solving. This tool enabled students to use hints if they got stuck, watch specific video tutorials, and check the results of the proposed problems (see Figure 1).
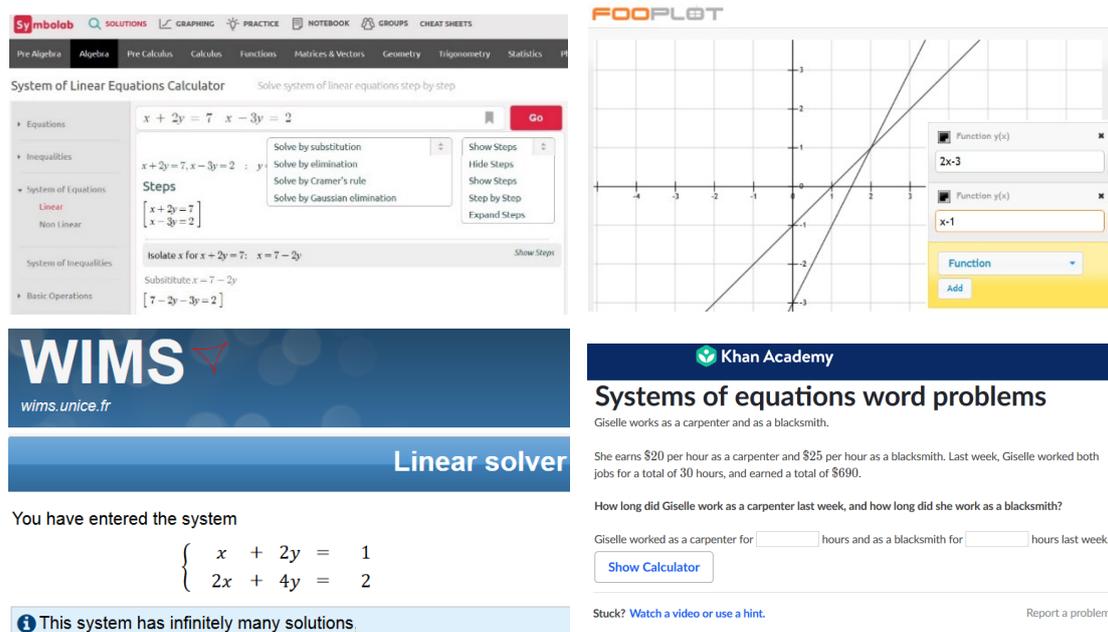

Figure 1. Main math digital tools used during the intervention.

2.3.6. Teacher Training

The teacher whose students were assigned to the experimental condition received two training sessions of about one hour each. The training sessions were delivered by two qualified instructors who also served as researchers in the field. During the first session, the teacher was instructed on the fundamentals of reciprocal peer tutoring [14]. The teacher watched videos presented by professional researchers with expertise in the specific topics for which the class intervention took place. Elements such as the correction of mistakes, patience, and positive feedback were highlighted, and issues such as differences in the speed at which students complete their tasks and the incompatibility of pairs due to behavioural issues were addressed. During the second session, an intervention trial was performed during the teacher's classes. He was given feedback by the researchers during the intervention. After the trial, the teacher asked several questions that had emerged during the session, which were answered by the researchers.

2.3.7. Student Training

Students in the experimental group received two training sessions on tutoring procedures two weeks before the start of the reciprocal peer tutoring program. The same teacher who taught the students during the school year conducted these training sessions under the supervision of the researchers. Through active participation, students were asked to indicate the qualities that competent tutors and tutees should have in order to successfully tutor and be tutored. They were also told that they all shared a common goal in this process: ensuring that every classmate understood and finished the exercises and problems by the end of each tutoring session and knew how to use the math digital tools. "Pause, Prompt, and Praise" techniques were also discussed, and the importance of patience and respect was emphasized [39]. Moreover, students were told that interactions between them had to be rich in mathematical content, so they should not talk about non-related issues during the peer tutoring sessions. The importance of explaining mathematical content and procedures in different ways was also highlighted.

2.3.8. Teacher's Role and Distribution

The teacher in the experimental group facilitated the reciprocal peer-tutoring sessions and supervised interactions between students. It was the teacher's responsibility to ensure that these interactions proceeded in a respectful environment, that the work was limited to the exercises and problems covered in each session, and that effective academic help was provided [40]. To avoid any teacher effect during the intervention, the same teacher taught all the students participating in this study.

2.3.9. Classroom Dynamics during Intervention

At the beginning of each session for the experimental group, the teacher took approximately 15 min to explain new content. Then, students were given approximately 15 min to complete a series of exercises and/or problems related to that new content, working individually. During that time, students were allowed to ask the teacher questions about how to complete the exercise or solve the problem. Meanwhile, the teacher checked the procedures the students were following and their results, making sure that at least one of the students from each pair had the correct answers, while providing feedback. When the 15 min were over, a reciprocal peer-tutoring session was held for about 25 min. Working in their assigned pairs, the students had to check the work they had done Individually by comparing their results, sharing their procedures, and asking each other questions and also work together to solve those tasks that they had not been able to finish individually. Even if a pair of students had solved all tasks correctly, eliminating the need for tutoring, they were still required to share the procedures they had employed. When the two paired students arrived at different answers to a problem, the students tried to identify the mistake together, and the student with the correct answer had to help the other student understand how to complete the problem correctly. They had to check their results using the math digital

tools available on the tablet. Although students were allowed to ask questions regarding the exercises and problems during tutoring and to use the math digital tools, perseverance and individual effort were a must. If a pair of students was unable to solve a task correctly after working together, the teacher provided assistance. By the end of each tutoring session, all students had to be able to solve the exercises and problems individually, both by hand and using the math digital tools indicated previously (see Figure 2). Extra exercises and problems were given to student pairs who completed their work early. During the last 5 to 10 min of the session, the teacher responded to any remaining questions from students.
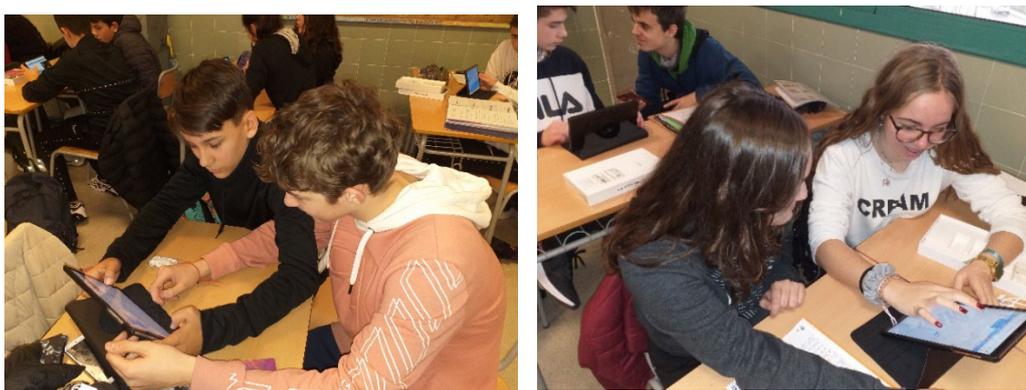

Figure 2. Students working in pairs with the math digital tools.

2.4. Instruments Used to Collect Quantitative Information

The scores on the exam for the previous mathematics unit (equation solving) were used as a pretest for both the experimental and the control group. Students were given a mark between 0 and 10 on this exam, which covered the following: first- and second-degree equations (2 points), biquadratic equations (2 points), factoring equations (grade greater than two, 3 points), and problem solving through equations (3 points). After the peer tutoring intervention, students in both the experimental and control groups took another exam (systems of equation solving) for the unit that was covered with both groups (during the intervention with the experimental group). The scores on this last exam were used as a posttest. Students were given a mark between 0 and 10. The exam included the following: one exercise to identify the type of system (1 point), one exercise in which students had to analytically solve three systems in the three different ways (4 points), one exercise of solving graphically (2 points), and two problems (1.5 points each). Students were given an hour and a half to complete each exam (pretest and posttest). The exams were completed in February 2020 (pretest) and March 2020 (posttest, after the intervention). The students completed the exams during regular mathematics classes.

2.5. Instruments Used to Collect Qualitative Information

One method used to collect qualitative information from the students was focus groups. Three focus groups with four students each were conducted by one of the researchers. A draw was performed with the 28 students in the experimental group until twelve of them were selected; after being selected, students were asked to participate in the focus group voluntarily. Students were asked questions referring to the experience and the adequacy of combining peer help with the math digital tools, such as (1) "How useful did you find the math digital tools to be?" and (2) "How did you feel during the peer tutoring sessions?" These focus group sessions lasted about 12 min each and were held during tutoring hours in private spaces. As an additional approach to collecting qualitative information from the students, the teacher carried a field diary with him during the sessions of both the experimental and the control group. Throughout his active participation in the development of these sessions, he entered comments made by the students in the diary or documented situations that would possibly be interesting for the research.

2.6. Measures against Hawthorne-Effect

None of the students participating in this study was told that the tutoring intervention was linked to the administration of tests; in other words, they were not informed that they were taking part in research involving an intervention. Moreover, to the degree possible, the researchers in this study worked to prevent a Hawthorne effect, that is, students modifying their conduct or responses in the tests due to their awareness of being under study [41].

2.7. Statistical Analysis

SPSS software version 26 was used to perform all quantitative analyses. Means and standard deviations were calculated for all variables. Student's *t*-test (95% confidence level) was used to analyse the differences between the posttest scores and the pretest scores and the differences between the control group and experimental group scores. Given the fact that multiple comparisons were carried out in this research, the Sidak correction was used [42], so the minimum *p* value for considering statistical significance was reduced from 0.05 to 0.02. The overall effect size was reported using Hedge's g as a measure [43]. Although the rule of thumb for effect sizes has recently raised controversy in interventions in education [44], the rule of thumb and the benchmarks provided by Bloom et al. [45] and Rios [46] were considered when interpreting effect sizes in this study.

Qualitative data were analysed using content analysis and ATLAS.ti software version 8.1 (Berlin, Germany). After introducing all the comments and descriptions obtained through the focus groups and from the field diary, researchers analysed the information, and two main dimensions were defined: motivation towards using digital tools and way of learning. Information from the field diary was codified as follows: STD_32 refers to student number 32 (only the first 28 students belonged to the experimental group). Information coming from the focus group was codified as follows: FG1_3 refers to focus group number 1, student number 3. Student names cited in Section 3 were invented for anonymity reasons.

2.8. Treatment Fidelity

Several procedures were followed to address treatment fidelity. Students' daily attendance was controlled through Itaca, an online platform provided by the Valencian Ministry of Education for all teachers in public schools. Teachers were able to record each student's attendance for every session using this platform. Notes about students' behaviour, direct messaging with students' parents, and the input of qualifications are some of the other functions this platform provides. All participants in this study had to attend at least 95% of the scheduled sessions. If a student did not behave properly during the intervention (e.g., being reluctant to help a peer), they were dropped out of the research. Kaspersky Safe Kids, a software that monitored the students' use of the tablets (websites accessed, apps used, and so on) was installed on each tablet. Students were warned at the beginning of the intervention that they were being monitored through this app and that they must use the tablet only for the purposes indicated previously. No significant violations of the intervention protocol were reported regarding student attendance or behaviour.

2.9. Research Questions

The research questions that were defined for this study were as follows:

1. What are the effects of peer tutoring in combination with math digital tools on students' mathematics achievement?
2. What are the effects of peer tutoring in combination with math digital tools on the way students learn and their motivation towards using digital tools during mathematics class?

3. Results

3.1. Results for Research Question 1: Effects of Intervention

Quantitative descriptive results for mathematics achievement are reported in Table 1. Means ($\overline{X}$) and standard deviations (*SDs*) are indicated for the pretest and the posttest for

both the experimental and control groups. These results are graphically represented in Figure 3 with the standard deviations in parentheses so that readers' global vision of the results is facilitated.

Table 1. Overall descriptive mathematics achievement results for the experimental and control groups.

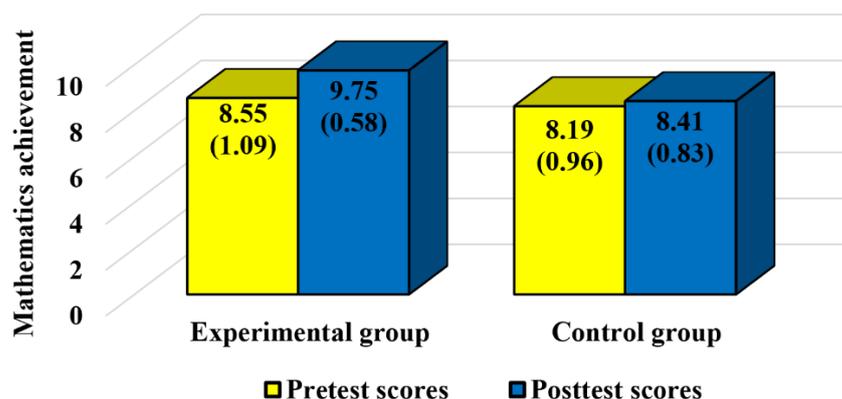| Pretest						Posttest					
Experimental			Control			Experimental			Control		
M	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*	*n*
8.55	1.09	28	8.19	0.96	84	9.75	0.58	28	8.41	0.83	84

Figure 3. Experimental group and control group pretest and posttest scores and standard deviations.

Results by mathematics domains during the intervention for the experimental and control groups are shown in Table 2 and Figure 4.

Table 2. Descriptive results by mathematics domain for the experimental and control groups.

Domain	Experimental Group			Control Group		
	$\overline{X}$	*SD*	*n*	$\overline{X}$	*SD*	*n*
Identifying type of system	0.96	0.10	28	0.87	0.19	84
Three ways of analytically solving	3.95	0.07	28	3.41	0.52	84
Graphical solving	1.95	0.04	28	1.61	0.28	84
Problem solving	2.89	0.29	28	2.52	0.33	84

Statistically significant differences were reported between the pretest and the posttest for the experimental group ($t = 5.14$, $p < 0.01$). An overall Hedge's g effect size of 1.36 was reported for the intervention. No statistically significant differences were reported between the pretest and the posttest for the control group ($t = 1.59$, $p = 0.11$).

The experimental group outscored the control group in each analysed domain. Statistically significant differences were found between the experimental and the control groups for the scores of all domains: identification of type of system ($t = 2.37$, $p = 0.02$, Hedge's g = 0.51); three ways of analytical solving ($t = 5.46$, $p < 0.01$, Hedge's g = 1.18); graphical solving ($t = 6.38$, $p < 0.01$, Hedge's g = 1.38); and problem solving ($t = 5.29$, $p < 0.01$, Hedge's g = 1.15).
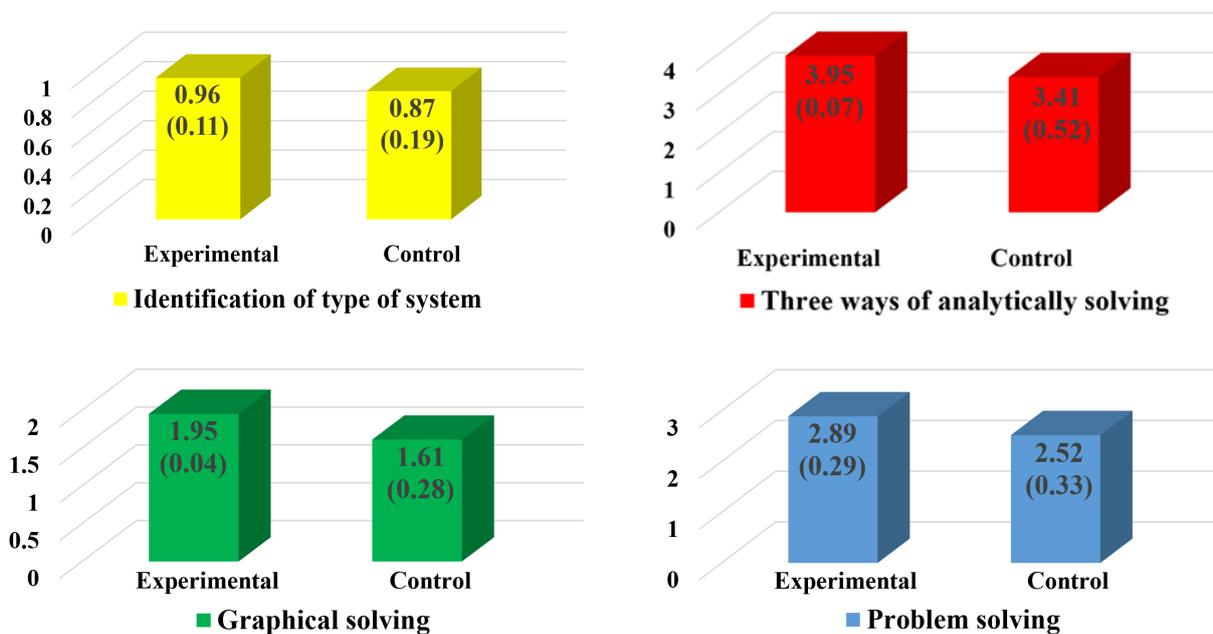
Figure 4. Experimental and control group scores and standard deviations by mathematics domain.

3.2. Results for Research Question 2: Effects on Way Students Learn

The information obtained from the focus groups and field diary analysis revealed that students in the experimental group showed a high level of enthusiasm from the first moment they saw the tablets in the classroom on the first day of the intervention. They asked many questions even before the teacher said anything about them: STD_3 *"Are these tablets just for us or are we going to share them with students of other classrooms?"* STD_21 *"Can we take them home?"* STD_23 *"Are we going to use them in more subjects or only in mathematics?"* STD_15 *"What are we going to use them for?"* The fact that it was the first time the students had used the tablets in the class resulted in their exhibiting high enthusiasm from the start. *"I'm thrilled! Are we going to work with a new app today?"* STD_16. The enthusiasm in the experimental group was evidently higher than their peers in the control group. However, it also resulted in the experimental group starting off slowly due to their lack of strong knowledge of digital math tools. During the first four sessions (first week) of the intervention, students in the experimental group asked the teacher many questions regarding the use of the digital tools, and this group had difficulty finishing the scheduled exercises and problems on time during those sessions compared to the control group. After these first four sessions (first week), however, students in the experimental group began to develop autonomous learning skills. They asked the teacher very few questions about wrong results in an exercise or problem in comparison to the control group, as they were able to identify their mistakes by consulting the procedures on the digital tools. Moreover, the fact that they could help themselves in pairs in a structured way resulted in fewer questions regarding procedures for solving exercises and problems compared with students in the control group: STD_4 (after a teacher explanation) *"I'm not sure I have understood everything, but don't worry, I'll ask Tym just in case."* Students' self-checking of exercises enabled them to quickly correct exercises and problems on the conventional blackboard. Consequently, students in the experimental group completed a higher number of exercises and problems than students in the control group. During the whole intervention, students in the experimental group completed approximately 38.89% more exercises (25 vs. 18) and 33.33% more problems (16 vs. 12) than students in the control group. Moreover, it was reported that students in the experimental group understood the associations of mathematics content in this unit much better than students in the control group. For instance, the point of intersection of two straight lines graphically and the analytical solution of the system of equations was very clear for students in the experimental group

but not for those in the control group: STD_57 (third week of intervention) *"Ok, this is the solution of the system, and what does it mean?"* STD_67 (fourth week of intervention) *"Alright, I have found a solution to the system, but now how can I know if it is right?"*

Analysis of the data gleaned from the focus groups showed that students in the experimental group were highly satisfied with the experience: FG_1_5 *"It's been great to do something different in mathematics"*; FG_2_16 *"We should use the tablets more in mathematics and other subjects. I know there are good apps for technology subjects to solve electric circuits. It gives you all, voltage, intensity . . . "* The results also indicated that they enjoyed helping each other and that helping behaviour had increased: FG_1_7 *"Luca and I helped ourselves a lot. He is very good at math, but I'm better than him with the tablet. We are a good team"*; FG_3_25 *"Nancy and I know that we always talk a lot in math class, but I think this time we talked much more about math than about other issues."*

4. Discussion

4.1. Discussion for Research Question 1: Effects of Intervention

The fact that statistically significant differences were reported between the experimental and control groups for all the analysed mathematics domains is consistent with similar studies in the field. The combination of peer learning and digital tools most often results in significant academic improvement for students [47–50]. Most authors argue that incorporating two simultaneous resources (peer help and a digital tool) is an academically powerful option that fosters students' acquisition of curricular content. Hence, the fact that the experimental group (peer tutoring combined with math digital tools) outscored the control group (no tutoring or math digital tools) and reported significant improvements was expected, considering the previous results in similar studies in the field. Nevertheless, the reported effect sizes in these types of studies (and specifically for mathematics) are usually moderate [51–55]. That was not the case in this study, however, as large effects were reported in three of the four analysed domains. As Bernacki et al. [56], Confrey et al. [57], and Rød and Nubdal [58] indicated, the feedback provided by digital learning systems is very helpful in mathematics, as students' difficulties are diagnosed more quickly than they are in traditional learning environments. This digital feedback complemented with feedback received from peer help [59,60] may have helped students more accurately detect the content that was more difficult for them and therefore have facilitated important improvements in their academic achievement, as being better able to detect their difficulties enabled them to make improvements in learning the content in which they were less competent or that was more challenging for them [61–64]. Additionally, the fact that the form of tutoring they participated in was reciprocal may have also significantly improved the students' mathematics anxiety [65,66] and mathematics self-concepts [67], two variables that have been frequently correlated with academic achievement [68–71] which may have provoked an even higher increase in the effects of the intervention.

4.2. Discussion for Research Question 2: Effects on Way Students Learn and Their Motivation towards Using Math Digital Tools

The fact that students in the experimental group were more enthusiastic about learning during mathematics classes is consistent with the findings of analogous studies in the field [72–74]. According to these authors, ICT for mathematics education most often raises enthusiasm amongst first-time users, so it was expected that students' motivation would be fostered by the incorporation of these tools. The fact that autonomous learning was increased in the experimental group is also consistent with the findings of other recent studies in the field in which electronic tablets were introduced in mathematics subject learning activities [75–77]. Authors in the field argue that when students were able to check their own results and correct their own procedures, they became more independent from a pedagogical perspective, increasing their autonomy and requiring less support from their teachers or instructors [78–80]. The fact that students could associate different mathematical concepts in a more complex way is rational considering that these associations were

promoted in three ways (teacher's explanations, peer's help, and analytical and graphical developments of the digital tools) instead of just the one way (teacher's explanations) of traditional learning [81–84]. Finally, the fact that students in the experimental group did more exercises and problems than those in the control group may be attributable to two main factors: the helping behaviour that usually arises during peer tutoring interactions [85–88] and the instant feedback provided by the digital tools [89–91].

4.3. Limitations

Although the results in this research may seem very promising, important limitations must be considered when interpreting them. Readers must keep in mind that these results constitute only a preliminary approximation of the accurate and precise effect that peer tutoring combined with math digital tools may have for middle school students. Under no circumstances can the results of this research be considered representative of a certain population for the following reasons: the small sample size (only 112 participants), the limited sample power, and the fact that only a quarter of the students were assigned to experimental condition due to the limited number of resources available [92]. Moreover, the fact that all students belonged to the same school is also an important limitation that must be considered [93,94]. Four weeks of intervention cannot be regarded as a long time for implementation. In this case, there was no possibility to continue with the experience because all schools in Spain closed for the remainder of the school year two weeks after the intervention due to the COVID-19 pandemic. Ceiling effects must also be taken into consideration, as 3.57% of students in the experimental group and 2.38% of students in the control group had already achieved the maximum score on the pretest [95]. Finally, the use of non-standardized and non-validated tests in this research must also be regarded as a strong limitation [96].

4.4. Future Research

Several lines of research are open in the field of peer tutoring and mathematics digital tools, and some potential studies may arise from this research. Most importantly, it would be interesting to determine in a more accurate way the effect of the combination of peer tutoring and math digital tools. It is uncertain to what extent the large effect sizes reported in this research are due to peer tutoring and to what extent they are due to the use of the digital tools. A comparison between four similar groups of students [97,98], one receiving only peer tutoring, another only using digital tools, another with no tutoring or digital tools, and the other analogous to the experimental group in this research would shed more light on the influence the combination has on students' academic achievement in mathematics. Moreover, as previously indicated in Section 4.3 Limitations, the sample used in this research cannot be considered representative of a large population. An analogous research study with a larger sample would imply a more accurate determination of the effects of this combination on students' math achievement. In this sense, readers must bear in mind that the effect sizes shown in this research are very large compared with those expected for peer tutoring interventions in mathematics [99,100] or with those for interventions in which digital tools are incorporated into mathematics secondary education [101–103], so more research is needed along these lines. In this regard, as pointed out in the Section 4.2, the fact that the students worked with digital tools in mathematics for the first time in this research could have also produced an overestimation of the effect sizes in this research. Analysing the long-term effects of this combination as well as its effectiveness when students were already used to digital tools could be interesting from a research perspective [104–106]. Moreover, given the promising results shown in recent studies with special education students, future research including students with special needs is highly recommended [107–109]. Finally, given the enthusiastic response of students to the intervention in this research, the analysis of psychological variables, such as mathematics self-concept or mathematics anxiety, in addition to the academic achievement variable is also suggested for future studies [110,111]. Determining how this type of intervention

influences students not only academically but also psychologically is key to gaining a better understanding of the way students learn during this type of experience [112–115].

5. Conclusions

The main conclusion is that reciprocal peer tutoring in combination with math digital tools may be very beneficial for middle school students when working with systems of linear equations for several reasons. On one hand, students' mathematics achievement is expected to increase considerably with the intervention, promoting greater autonomous learning among students and a greater association of mathematics concepts. On the other hand, students' helping behaviour and satisfaction should increase at the same time they do more exercises and problems within the same amount of time than with conventional ways of instruction (unidirectional learning, limited interactions between students, and so on). Readers of this manuscript must consider that while the results of this research may seem very promising and the potentiality of intervention appears to be high, important limitations must be considered. Factors such as the novelty of the use of digital tools by participants and the relatively small sample, as well as the limited time of the intervention, among others, may have resulted in an overestimation of the effects in this study. Further research is necessary to determine in a precise and accurate way the real effects of peer tutoring combined with using math digital tools on middle school students' learning and achievement.

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